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(54) **GRAPHENE DEVICE, METHOD OF INVESTIGATING GRAPHENE, AND METHOD OF OPERATING GRAPHENE DEVICE**

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(57) **ABSTRACT**

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The present invention provides for a graphene device comprising: a first gate structure, a second gate structure that is transparent or semi-transparent, and a bilayer graphene coupled to the first and second gate structures, the bilayer graphene situated at least partially between the first and second gate structures. The present invention also provides for a method of investigating semiconductor properties of bilayer graphene and a method of operating the graphene device by producing a bandgap of at least 50 mV within the bilayer graphene by using the graphene device.

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